Prioritization in isolation

– a reality in Infection Control

WH Seto
Chief Infection Control Officer
Hong Kong, China


1935

2004

Daniel Seto

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

Airborne Precautions

A. Patient Placement

Place the patient in a private room
(with appropriate standards of a –ve pressure room)

The preferred placement for patients who require Airborne Precautions is in an airborne infection isolation room (AIIR).

Contact Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Contact Precautions.

Droplet Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Droplet Precautions.

→ "When single-patient rooms are in short supply, prioritize patients"

The super bugs

Poor

understanding

of

Infection

Control

Definitions

- **MDR (multidrug-resistant)**
  - Resistance to ≥3 classes of antimicrobial agents
- **XDR (extensively drug-resistant)**
  - Resistance to all* but 1 or 2 (colistin or tigecycline)
- **PDR (pandrug-resistant)**
  - Resistance to all*

*Antimicrobial agents that are available at the time of use of the definition and in most parts of the world and that are regarded as potentially effective against the respective pathogens

Falagas ME et al. *Clin Infect Dis* 2008;41:848-54.
Souli M et al. *Eurosurveillance* 2008;13:1-11.

Aspects of antimicrobial resistance in the Western Pacific Region – 2009 data.

	Hong Kong (major hospitals)	Thailand	Malaysia	Taiwan (ICU)	China (2007)	Korea (2007)	Aust.	Japan (2008)	S'pore
% MRSA in Staph. aureus	39%	NP	21%	80%	60%	64%	34%	64%	NP
E. coli R to Imipenem	0%	0%	0.1%	0%	1%	NP	0%	0%	NP
% of ESBL-producing E. coli	25%	25%	NP	22%	35%	22%	2%	18%	23 %
Ps. aeruginosa R to Imipenem	5%	19%	7%	16%	33%	20%	NP	19%	NP
Acinetobacter spp R to Imipenem	39 %	64%	47%	56%	23%	20%	NP	64%	NP

ESBL: Extended Spectrum Beta-lactamases; NP: data not provided.

Infection Control Measures for reducing Antibiotics Resistance

IC Measures	Key Mechanisms	Main HCWs
1. Surveillance	Identify sources Identify outbreaks Feedback of data Monitor control measures	IC team Microbiology Laboratory Staff
2. Good Patient-care practices	Reduction of spread	IC team implement & HCW's compliance
3. Disinfection & sterilization	Reduce contamination remove common source	IC team implement HCW's compliance
4. Isolation	Contain source & reduce transmission	IC team implement & HCW's compliance
5. Modify host risk profile	Reduce colonization halt infection	Physicians & nursing staff

Control of MDRO- Tier one – CDC guideline - 2006

Surveillance:

1. Laboratory testing of sensitivity
2. Notify Infection Control of cases for action
3. Report general sensitivity pattern to hospital
4. Monitor trends of organisms tested and in special units (eg. ICU)

Isolation:

1. Standard precautions
2. Contact precautions for MDRO cases
3. Prioritized single rooms

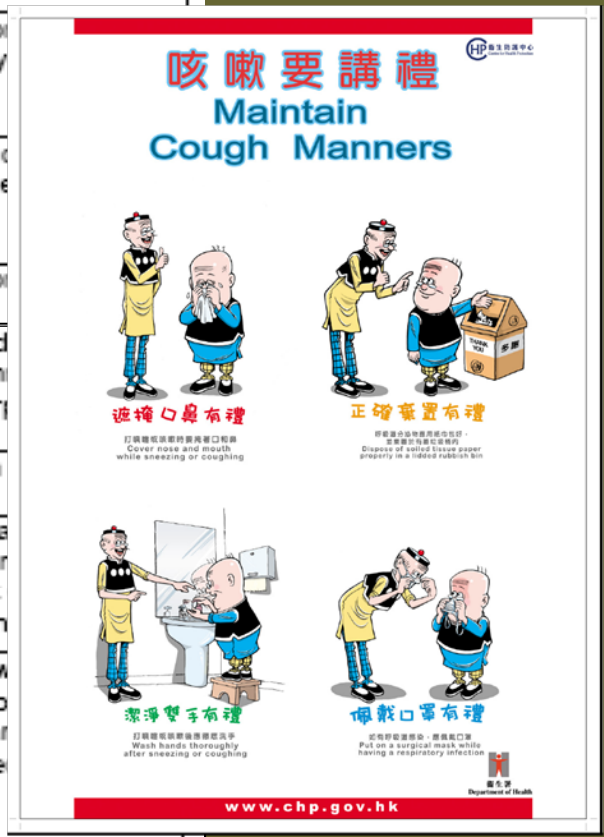
"No recommendations on when to discontinue CP"

Environment:

1. Standard cleaning of environment with focus on touched surfaces
2. Dedicated non-critical medical items to individual patients

Table 4: Standard Precautions in all Healthcare Settings

COMPONENT	RECOMMENDATIONS
Hand hygiene	After touching blood, body fluids, secretions, excretions, contaminated items; immediately after removing gloves; between patient contacts.
Personal protective equipment (PPE)	
Gloves	For touching blood, body fluids, secretions, excretions, contaminated items; for touching mucous membranes and nonintact skin
Gown	During procedures and patient-care activities when contact of clothing/exposed skin with blood/body fluids, secretions, and excretions is anticipated..
Mask, eye protection (goggles), face shield*	During procedures and patient-care activities likely to generate splashes or sprays of blood, body fluids, secretions, especially suctioning, endotracheal intubation
Soiled patient-care equipment	Handle in a manner that prevents transfer of microo others and to the environment; wear gloves if visibly contaminated; perform hand hygiene.
Environmental control	Develop procedures for routine care, cleaning, and environmental surfaces, especially frequently touche patient-care areas.
Textiles and laundry	Handle in a manner that prevents transfer of microo others and to the environment
Needles and other sharps	Do not recap, bend, break, or hand-manipulate used recapping is required, use a one-handed scoop tech use safety features when available; place used shar puncture-resistant container
Patient resuscitation	Use mouthpiece, resuscitation bag, other ventilation prevent contact with mouth and oral secretions
Patient placement	Prioritize for single-patient room if patient is at increa transmission, is likely to contaminate the environmer maintain appropriate hygiene, or is at increased risk infecton or developing adverse outcome following in
Respiratory hygiene/cough etiquette (source containment of infectious respiratory secretions in symptomatic patients, beginning at initial point of encounter e.g., triage and reception areas in emergency departments and physician offices)	Instruct symptomatic persons to cover mouth/nose w sneezing/coughing; use tissues and dispose in no-to receptacle; observe hand hygiene after soiling of har respiratory secretions; wear surgical mask if tolerate spatial separation, >3 feet if possible.



World Health Organization | Patient Safety

A World Alliance for Safer Health Care

WHO Guidelines on Hand Hygiene in Health Care

First Global Patient Safety Challenge Clean Care is Safer Care

US$0.5

100 mls

US$2.0

500 mls

Control of MDRO- Tier one – CDC guideline - 2006

Surveillance:

1. Laboratory testing of sensitivity
2. Notify Infection Control of cases for action
3. Report general sensitivity pattern to hospital
4. Monitor trends of organisms tested and in special units (eg. ICU)

Isolation:

1. Standard precautions
2. Contact precautions for MDRO cases
3. Prioritized single rooms

"No recommendations on when to discontinue CP"

Environment:

1. Standard cleaning of environment with focus on touched surfaces
2. Dedicated non-critical medical items to individual patients

Contact Precautions

When entering room – wear glove & change when needed

Hand hygiene leaving room

Wear gowns when substantial contact with environment or patient.

- Limit transport
- Designate noncritical patient care equipment to a single patient

Control of MDRO- Tier two

Rates are increasing or 1st case of important organism

Enhance Surveillance:

1.Prevalence survey of hospital
2.Survey of special units and/or patients at risk
3.Serial surveillance of contacts and/or special units (routine surveillance of admissions?)
4.Surveillance of HCW when there is epidemiologic evidence.

Isolation:

1. Routinely isolate cases and colonizers. Considering tagging and isolating readmissions of colonizers.
2. Stop new admissions if needed.
3. Close unit if needed

Environment:

1. Enhance consistency of cleaning. Consider dedicated staff.
2. Environmental cultures only when epidemiologically indicated
3. Vacate units for intense cleaning

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

Airborne Precautions

A. Patient Placement

Place the patient in a private room
(with appropriate standards of a –ve pressure room)

The preferred placement for patients who require Airborne Precautions is in an airborne infection isolation room (AIIR).

Contact Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Contact Precautions.

Droplet Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Droplet Precautions.

→ "When single-patient rooms are in short supply, prioritize patients"

It is thus accepted that there are situations in

which separation may not be absolutely necessary.

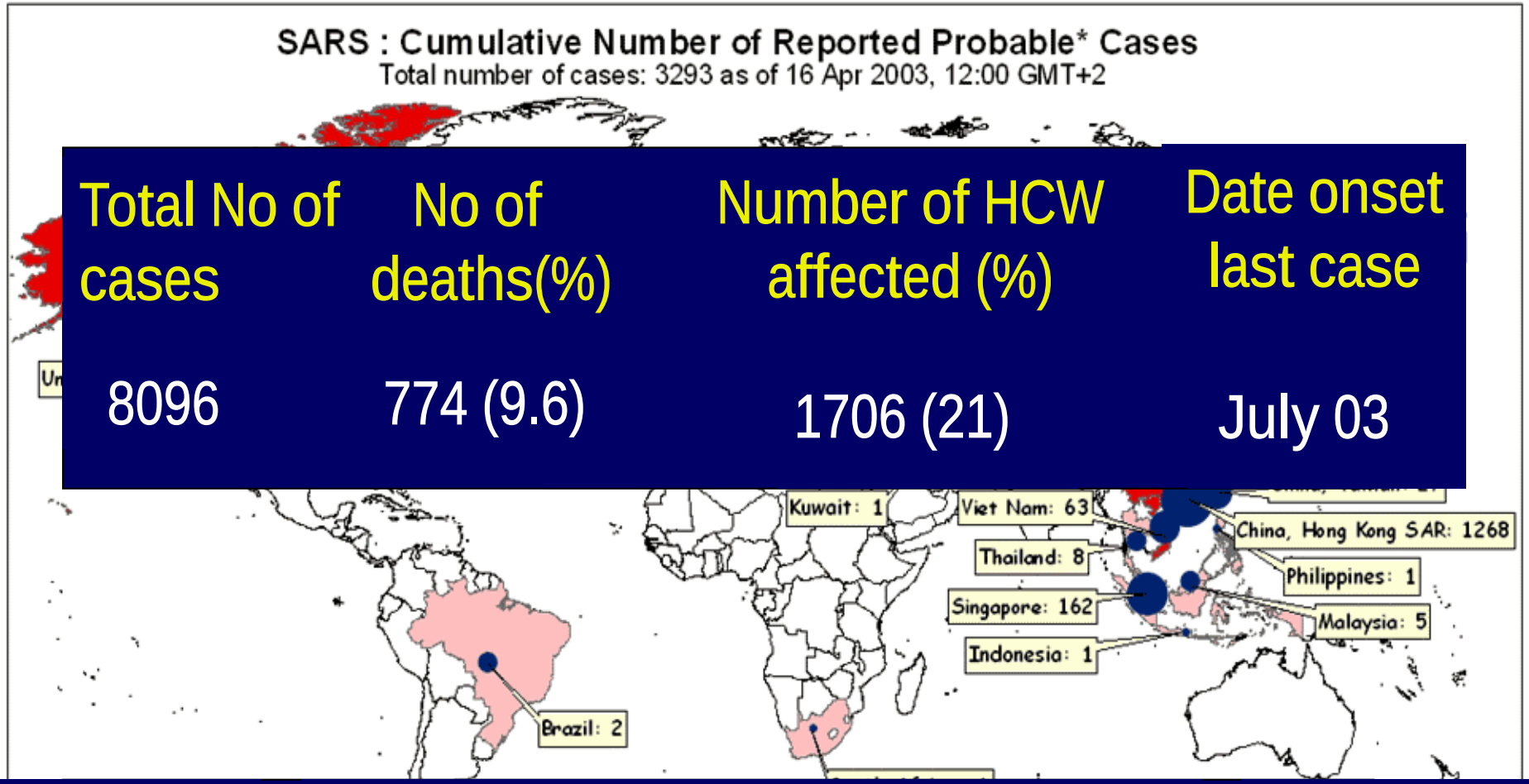
This is also suggested in the CDC MDRO guideline in 2006

Management of Multidrug-Resistant Organisms In Healthcare Settings, 2006 (CDC)

Factors that influence selection of MDRO control measures.

Although some common principles apply, the preceding literature review indicates that no single approach to the control of MDROs is appropriate for all healthcare facilities. Many factors influence the choice of interventions to be applied within an institution

SARS came to Hong Kong and
hand hygiene reach close to 90% compliance



Total No of cases	No of deaths(%)	Number of HCW affected (%)	Date onset last case
8096	774 (9.6)	1706 (21)	July 03

Country/ Province	No of cases	No of deaths(%)	Number of HCW affected(%)	Date onset last case
Hong Kong	1755	299 (17)	386 (22)	31 May 03

Survey in 2003

	Mean compliance (%)	Correlate (Spearman) with whether ward had staff infected	p
1. Mask	99	0.15	0.53
N95	55	0.23	0.36
Surgical	25	0.06	0.80
both	19	0.04	0.88
2. Glove	90	0.48	0.85
3. Gown	81	0.05	0.85
4. Faceshield	61	0.09	0.72
5. Goggles	46	0.18	0.47
6. Cap	76	0.20	0.43
7. Shoes-cover	15	0.02	0.92
8. Hand wash	97	0.09	0.74

*** 34 infected staff**

Comparing MRSA infections per 1000 Patient days

	2002	2003	
No of MRSA infections	522	464	
Patient days	40,4068	36,9163	
MRSA per 1000 patient days	1.29	1.25	p = 0.89

Comparing MRSA infections per 1000 Patient days

	2002	2003	
No of MRSA infections > 2 days in hospital	316	282	
Patient days	40,4068	36,9163	
MRSA per 1000 patient days	0.78	0.76	p = 0.806

The 2003 SHEA guideline for MRSA already stated that hand hygiene is not enough but isolation is needed

Special Report

SHEA Guideline for Preventing Nosocomial Transmission of Multidrug-Resistant Strains of *Staphylococcus aureus* and *Enterococcus*

Carlene A. Muto, MD, MS; John A. Jernigan, MD, MS; Belinda E. Ostrowsky, MD, MPH; Hervé M. Richet, MD; William R. Jarvis, MD; John M. Boyce, MD; Barry M. Farr, MD, MSc

ABSTRACT

BACKGROUND: Infection control programs were created three decades ago to control antibiotic-resistant healthcare-associated infections, but there has been little evidence of control in most facilities. After long, steady increases of MRSA and VRE infections in NNIS System hospitals, the Society for Healthcare Epidemiology of America (SHEA) Board of Directors made reducing antibiotic-resistant infections a strategic SHEA goal in January 2000. After 2 more years without improvement, a SHEA task force was appointed to draft this evidence-based guideline on preventing nosocomial transmission of such pathogens, focusing on the two considered most out of control: MRSA and VRE.

METHODS: Medline searches were conducted spanning 1966 to 2002. Pertinent abstracts of unpublished studies providing sufficient data were included.

RESULTS: Frequent antibiotic therapy in healthcare settings provides a selective advantage for resistant flora, but patients with MRSA or VRE usually acquire it via spread. The CDC has long-recommended contact precautions for patients colonized or infected with such pathogens. Most facilities have required this as policy, but have not actively identified colonized patients with surveillance cultures, leaving most colonized patients undetected and unisolated. Many studies have shown control of endemic and/or epidemic MRSA and VRE infections using surveillance cultures and contact precautions, demonstrating consistency of evidence, high strength of association, reversibility, a dose gradient, and specificity for control with this approach. Adjunctive control measures are also discussed.

CONCLUSION: Active surveillance cultures are essential to identify the reservoir for spread of MRSA and VRE infections and make control possible using the CDC's long-recommended contact precautions (*Infect Control Hosp Epidemiol* 2003;24:362-386).

SHEA Guideline **(ICHE 2003:24:362)**

"Recent mathematical models suggest ….relatively high rate of transmission when HCWs hands were not being clean."

"This suggests that reliance on hand hygiene alone (ie. without identifying colonized patients for use of contact isolation) is unlikely to control transmission"

"authors of the model concluded that strict isolation measures and surveillance cultures for identifying colonized patients should be considered by those trying to control these pathogens."

Lemmen et al, JHI 2004:56:191-197

- A study in 1500-bed teaching hospital
- Patients clinical samples with MRSA, VRE, Gram-ve resistant to 3 of the following classes: penicillins, 3rd gen cephalosporins, carbapenems, quinolones and aminoglycosides were selected
- For patients with +ve results, a standard sampling of 20 environmental locations (including hands)
- PFGE to establish clonal relationships between patients and environmental samples
- Patients in double room with unaffected neighbour and no clusters observes during study period

Isolation of multi-resistant pathogens from patients and their environment

Bacterial species	No. of patients	No. of **+ve** samples /samples taken (%)	*P*-value
MRSA	50	165/648 (25.5)	
VRE	4	9/57 (15.5)	
Total	**54**	**174/705 (24.7)**	
Pseudomonas aeruginosa	40	16/555 (2.9)	
Stenotrophomonas maltophilia	35	23/435 (5.7)	
Escherichia coli	20	12/271 (4.4)	
Enterobacter spp.	13	18/158 (11.4)	
Acinetobacter spp.	12	11/151 (7.3)	
Serratia spp.	10	17/148 (4.7)	
Klebsiella spp.	3	2/54 (3.7)	
Citrobacter spp.	2	0/36	
Alcaligenes spp.	1	0/19	
Total	**136**	**89/1827 (4.9)**	**<0.0001**

Lemmen et al, JHI 2004:56:191-197

Sampling of the hands of patients and hospital personnel

	Positive hands/ hands sampled for Gram+ve bacteria	Positive hands/ hands sampled for Gram-ve bacteria	*P*-value
Hands of patients	**17/52 (32.7%)**	**8/126 (6.3%)**	**<0.0001**
Hands of neighbour patients	**0/7**	**0/46**	
Hands of personnel	**6/38 (15.8%)**	**7/102 (6.9%)**	**0.1145**

Lemmen et al, JHI 2004:56:191-197

Detection rate of Gram-positive and Gram-negative pathogens in intensive care units versus general wards

	Positive samples/ samples taken for multi-resistant Gram+ve bacteria	Positive samples/ samples taken for multi-resistant Gram-ve bacteria
Intensive care units	**71/269 (26.4%)**	**61/753 (8.1%)**
General wards	**103/436 (23.6%)**	**28/1074 (2.6%)**

ICU disinfected 2x daily and General Wards 1x daily

Lemmen et al, JHI 2004:56:191-197

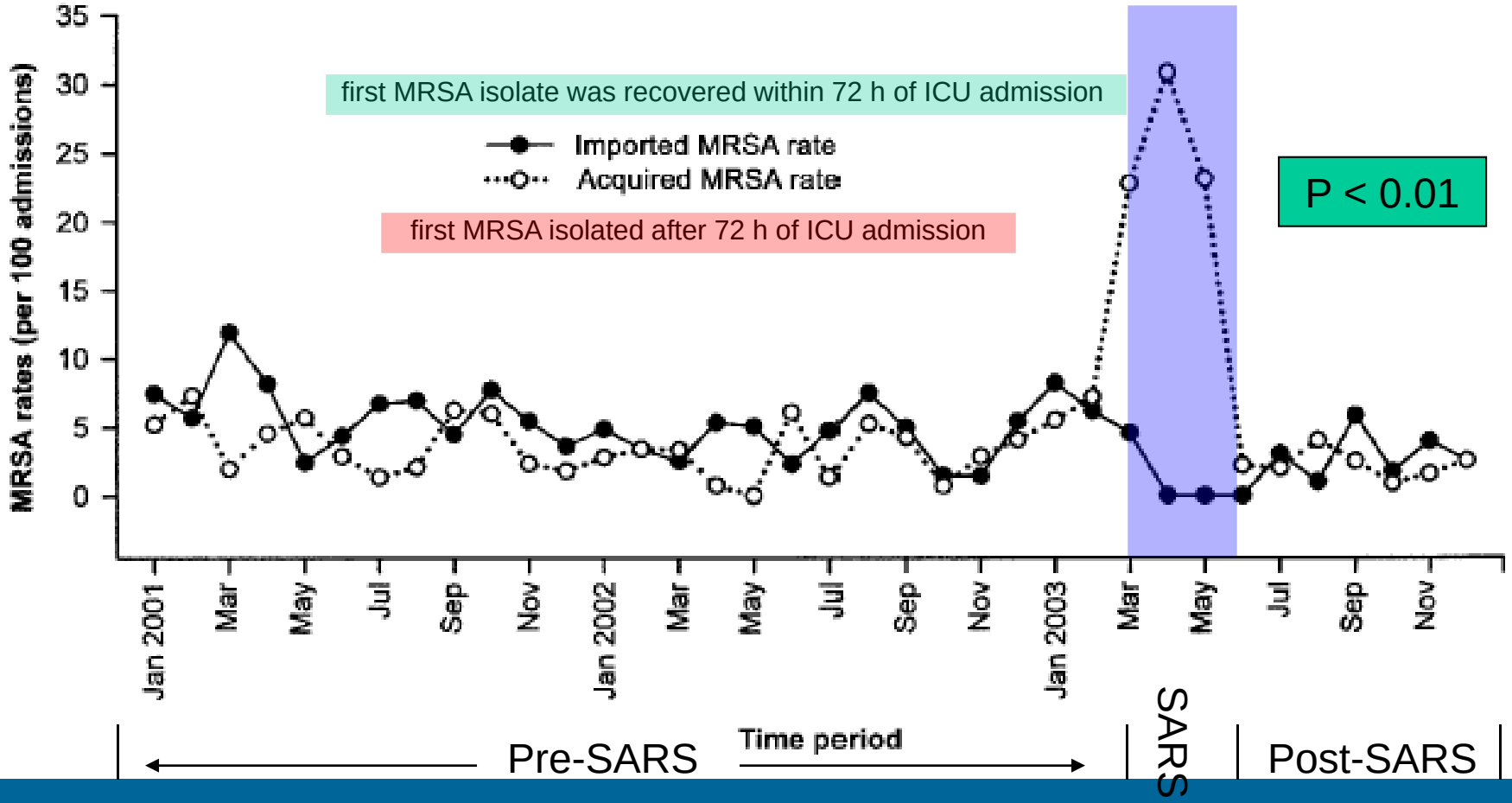
Lemmen et al, JHI 2004:56:191-197

- Environments and hands contamination by Gram+ve bacteria is significantly more frequent then Gram-ve
- This most likely due to Gram +ve organisms survive longer in the environment.
- Cross transmission of Gram-ve reported to be 5-23% while Gram+ve is 50% (from literature review).
- Different environmental disinfections have no significant impact.
- Isolation in a single room with contact precautions is highly recommended for Gram+ve bacteria
- Single room isolation for Gram-ve bacteria seems not necessary

Lammen et al study shows that the hands and environmental contamination of gram-ve is very much less and separation into isolation rooms may not be needed.

MRSA acquisition and VAP rates were collected prospectively

MRSA importation rates and acquisition rates (calculated as cases per 100 admissions)



Clin Infect Dis. 2004 Aug 15;39(4):511-6

Increase in Methicillin-Resistant *Staphylococcus aureus* Acquisition Rate and Change in Pathogen Pattern Associated with an Outbreak of Severe Acute Respiratory Syndrome

Florence H. Y. Yap,[1] Charles D. Gomersall,[1] Kitty S. C. Fung,[2] Pak-Leung Ho,[3] Oi-Man Ho,[1] Phillip K. N. Lam,[1] Doris T. C. Lam,[1] Donald J. Lyon,[2] and Gavin M. Joynt[1]

Departments of [1]Anaesthesia and Intensive Care and [2]Microbiology, Prince of Wales Hospital, Chinese University of Hong Kong, and [3]Department of Microbiology and Centre of Infection, Queen Mary Hospital, University of Hong Kong, HKSAR, China

22-bed intensive care unit

Upgrading of infection control precautions

change in antibiotic prescribing practices

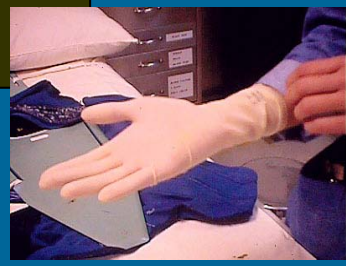
extensive use of steroids

wearing of gloves and gowns all the time

Clin Infect Dis. 2004 Aug 15;39(4):511-6

The use of gloves (CDC) MMWR, 2002, 51:RR-16

- **"Remove gloves after caring for a patient. Do not wear the same pair of gloves for the care of more then one patient.**
- **"Failure to remove gloves between patients contribute to transmission of organisms."**
- **"Change gloves if moving from contaminated to a clean body site [of same patient]"**
- **"Hands should be decontaminate or wash after removing gloves"**
- **"Gloves should not be washed or reused"**



So…do not wear gloves all the time

In line with Lemmen’s study, the gram-ve in Queen Mary Hospital shows a significant drop after SARS (unlike MRSA) after using analysis by segmental regression.

Comparing Pseudomonas aeruginosa infections per 1000 admission 2002 and 2003

	2002	2003	
No of PsA infections > 2 days in hospital	738	570	
Patient days	40,4068	36,9163	
Ps A per 1000 patient days	1.83	1.54	p = 0.0028

Comparing Pseudomonas aeruginosa (Gentamicin - R) infections per 1000 admission 2002 and 2003

	2002	2003	
No of PsA infections > 2 days in hospital	65	25	
Patient days	40,4068	36,9163	
Ps A per 1000 patient days	0.16	0.06	p = 0.0002

Comparing ESBL infections per 1000 admission 2002 and 2003

	2002	2003	
No of ESBL infections > 2 days in hospital	255	191	
Patient days	40,4068	36,9163	
ESBL per 1000 patient days	0.63	0.52	p = 0.04

Comparisons by Segmental Regression

	2002 vs 2003 Using segmental regression by Poisson model (p-value)
All MRSA infections	0.861
MRSA infections > 2 days	0.202
ESBL infections > 2 days	0.001
Psa infections > 2 days	0.001
Gen-R Psa infections > 2 days	0.020

Comparing Acinetobacter baumannii infections per 1000 admission 2002 and 2003

	2002	2003	
No of Acinetobacter infections > 2 days in hospital	259	197	
Patient days	40,4068	36,9163	
ESBL per 1000 patient days	0.64	0.53	p = 0.06

Mandell 6th edition pp2633

- “Acinetobacter may survive on dry inanimate objects for days, comparable to Staphylococcus aureus”
- “Acinetobacter can be found on both animate and inanimate objects”
- “Up to 25% of healthy ambulatory adults exhibit cutaneous colonization.”
- “It is the most common gram-ve organism persistently carried on the skin of hospital personnel”

Allen & Hartman

Mulin et al ICHE 1997:18(7):499-503

ICU converted from cubicles to Isolation Rooms

Impact on Acinetobacter Baumanii colonization in ventilated patients > 48 hrs

- Comparing colonization of ventilated patients in ICU before and after isolation rooms modification
  Colonization rate: Before: 28.1% After: 5% **($p < 10^{-7}$)**
- Pulmonary colonization or infection after 48 hrs:
  Before: 9.1 per 1000 patient days
  After: 0.5 per 1000 patient days **($p < 10^{-5}$)**
- PFGE shows similar types in both periods
- Logistic regression shows that colonization not associated with patient characteristics.

Conclusion:

- Conversion from open rooms to isolation rooms help to control nosocomial pulmonary acquisition of Acinetobacter baumanii
- Placement in isolation rooms is important for control
- The reason postulated is the improvement in compliance to IC practices in the isolation rooms.

Why is this not noted in Lammen's study?

Isolation of multi-resistant pathogens from patients and their environment

(Documented by PFGE)

Bacterial species	No. of patients	No. of **+ve** samples /samples taken (%)	*P*-value
MRSA	50	165/648 (25.5)	
VRE	4	9/57 (15.5)	
Total	**54**	**174/705 (24.7)**	
Pseudomonas aeruginosa	40	16/555 (2.9)	
Stenotrophomonas maltophilia	35	23/435 (5.7)	
Escherichia coli	20	12/271 (4.4)	
Enterobacter spp.	13	18/158 (11.4)	
Acinetobacter spp.	12	11/151 (7.3)	
Serratia spp.	10	17/148 (4.7)	
Klebsiella spp.	3	2/54 (3.7)	
Citrobacter spp.	2	0/36	
Alcaligenes spp.	1	0/19	
Total	**136**	**89/1827 (4.9)**	**<0.0001**

Lemmen et al, JHI 2004:56:191-197

Conclusions:

1. Very high compliance to Infection Control practices is needed to prevent the transmission of Gram+ve like MRSA/VRE and isolation rooms are shown to be needed for control.
2. Prevention of Gram-ve is less demanding and isolation rooms may not be necessary
3. Some Gram-ve like Acinetobacter may behave like like Gram+ve organisms in this respect and may require a higher level of compliance to Infection Control practices.
4. More research in this area is needed.

MRSA control - the Dutch model (since 1988)

ICHE, 1996; 17: 512-513; EJ Clin Micro 99:18:461; Infection 05: 5/6:309

- Screen all contacts (staff + patient) and in same ward of MRSA isolates.
- Screen: nose, throat, perineum, sputum, urine & wound x3
- Ward close with 2 MRSA case or 1 staff with MRSA
- All persons with MRSA are isolated in single rooms (infection or colonization)
- All staff caring for patients are screen daily (first 2 in 24 hrs)
- Mask, cap, gown and gloves for all entering room
- All patients from other countries isolated in single rooms and screened until 3 sets of –ve cultures.
- All carriers (patients and staff) treated with nasal mupirocin

Cost: US $250,000 for outbreak of 3-5 patients

No staff screening unless outbreak remains uncontrolled (2005)

Latest addition in Dutch model – surveillance is also now conditional

"It is recommended not to take surveillance cultures among staff members, unless the outbreak remains uncontrolled with the measures indicated above, and only if it is clear beforehand what will be done with a positive result."

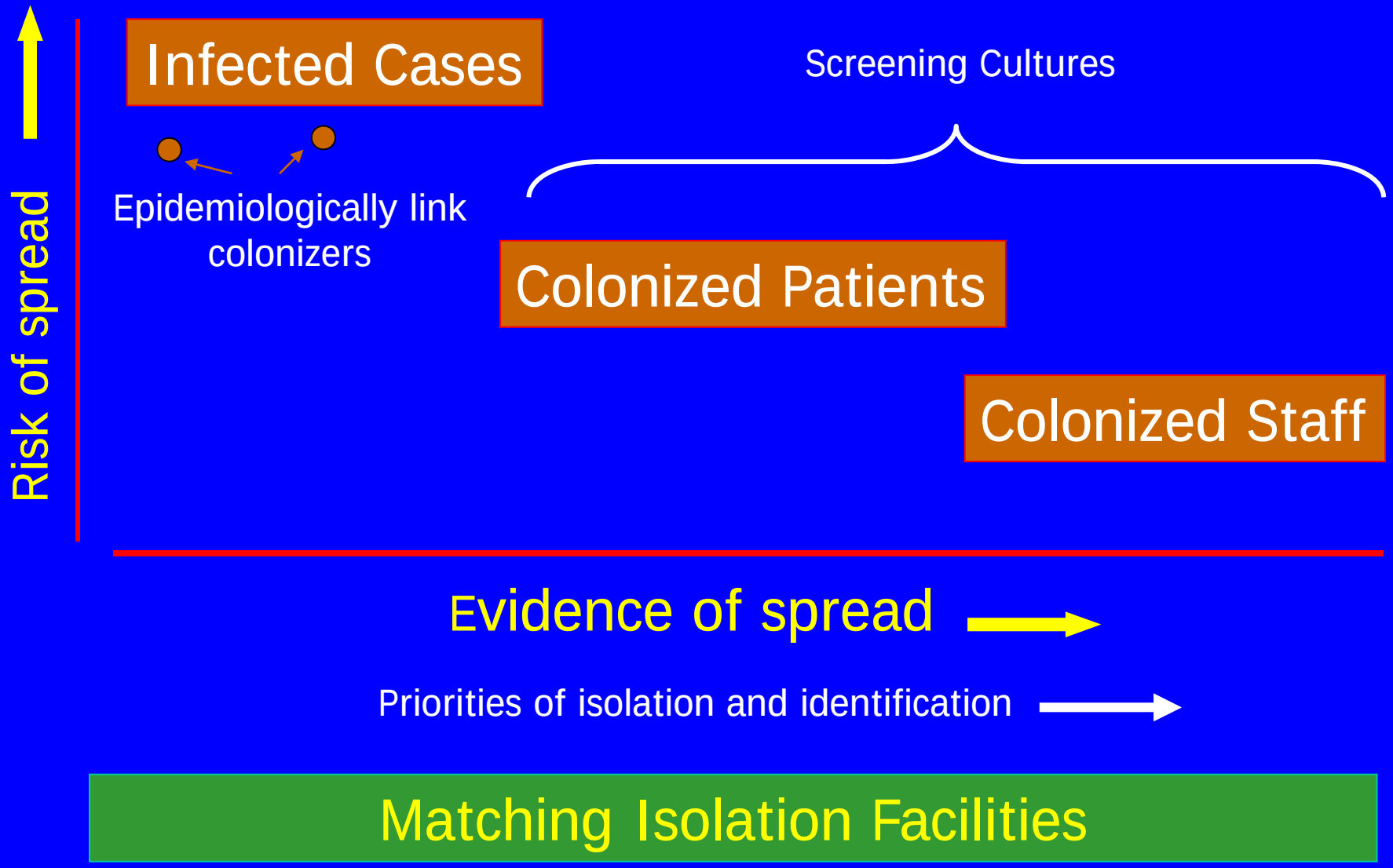
Kluytmans, Kluytmans, Voss Infection 05: 5/6:309

Priorities of Isolation for MRSA

- Proper contact isolation of all infected patients
- Screening of patient only when clusters evident in cubicle
- Screening of staff only when epidemiologically linked
- Isolate positive carriers until successful treatment
- Screening of all exposed patient and isolate carriers
- Screening of all staff exposed to MRSA patients

When outbreak is not controlled

Managing isolation facilities to MRSA control activities



Priorities for Isolation of Gram-ve organisms

- When it is really PDR (pan-drug resistance)
- When it is XDR and new to the locality.
- When it resistance is to key antibiotics & plasmid mediated
- When there is uncontained secretions
- When clusterings are demonstrated
- When it is a sensitive political issue

Canada policy

Initiation of Isolation Precautions: WHO??

- ***MRSA, VRE: Contact precautions***
  - Ward staff: Nurse calls for Isolation cart/signage for room
- ***ESBL: Contact precautions***
  - Unclear: ICP assesses if patient continent, no open wounds, good hygiene→ may decide isolation not needed

Record of initiation often not documented on patient chart

The policy in Hong Kong public hospitals is not single room for ESBLs. There is also not enough single rooms.

With good infection control practices the rate of ESBLs has remain stable in the hospital.

Isolation Policies in Hospital Authority – Hong Kong

IC tactics	MRSA BSI	VISA/ VRSA	VRE	ESBL	CRE	CRAB/ MDRA	CRPA/ MRPA
Single room	No	Yes	Yes	No	If available	If available (MDRA)	Yes (MRPA)
PPE, HH, EnH, Deq	HH	Yes	Yes	HH	Yes	Yes	Yes
CMS alert	No	Yes	Yes	No	Yes	MDRA	Yes
Discharge to RCHE	Allowed	**3 –ve culture**	**3 –ve culture**	Allowed	3 –ve culture	Allowed	MRPA: 3 –ve culture
Send isolate to reference lab	No	Yes	Yes	No	Yes	No	No
Notify Dept Health.	No	Yes	Yes	No	No	No	MRPA: Yes

Hong Kong 40 Public Hospitals (90% of hospital beds) policy is not to isolate ESBLs in single rooms

ESBLs however seems stable

	MRSA BSI	VISA/ VRSA	VRE	ESBL	CRE	CRAB/ MDRA	CRPA/ MRPA
Trend	Decreasing (11.9% drop)	rare	Slightly increasing	stable	Increasing	increasing	steady

MRPA=concomitant R to Imipenem, Ceftazidime. Amikacin and Ciprofloxacin
MDRA= concomitant R to Fluoroquinolones, Aminoglycosides, Cephalosporins and BL/BLase inhibitor combinations

ESBLs Isolated from Patients > 48 hrs admissions

	2008	2009	2010 (10 months)	
Incidence per 1000 PBDs (E. coli & Klebsiella spps).	0.75	0.77	0.76	p = 0.43

Monthly isolates of ESBLs > 48 hrs

Total E coli and Klebsiella spps (n)	2145	2193	2126	
ESBLs	648(30%)	697(32%)	704(33%)	p=0.12

There are also reports of successful reduction of ESBLs by standard precautions. (JHI, 2010, 75(1):33-6)

Also the failure of contact precautions until strong reinforcement of Infection control measures (Infect Cont Hosp Epidemiol 2008;29:517-524).
It was not tried but perhaps the reinforcement alone can already make a difference.

Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007

Airborne Precautions

A. Patient Placement

Place the patient in a private room
(with appropriate standards of a –ve pressure room)

The preferred placement for patients who require Airborne Precautions is in an airborne infection isolation room (AIIR).

Contact Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Contact Precautions.

Droplet Precautions

A. Patient Placement

Place the patient in a private room.

A single patient room is preferred for patients who require Droplet Precautions.

→ "When single-patient rooms are in short supply, prioritize patients"

Figure 3. Example of negative-pressure room control for airborne infection isolation (AII)* + §¶

Airborne infection isolation room (AII):

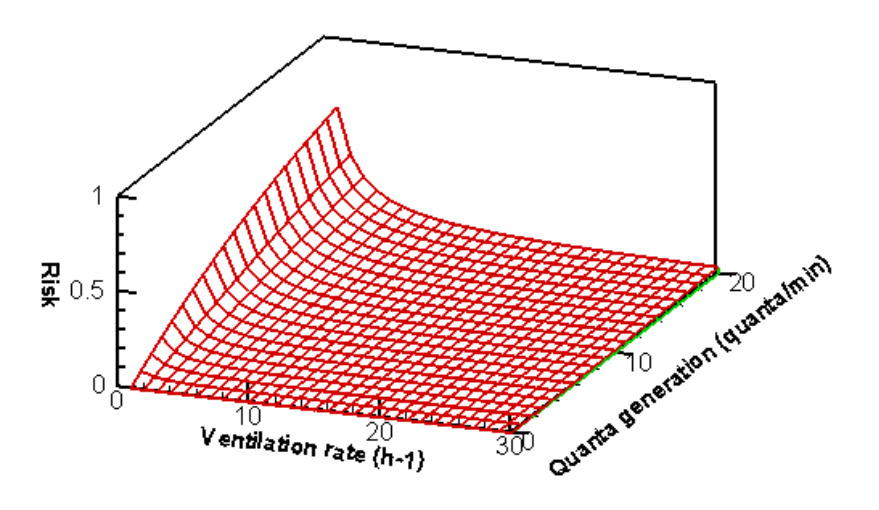
- **Single room or cohorting**
- **Negative pressure** (-2.5 Pa)
- **12 air changes per hour for new renovations**
- **Exhaust air outside or recirculated by HEPA filters**

* S

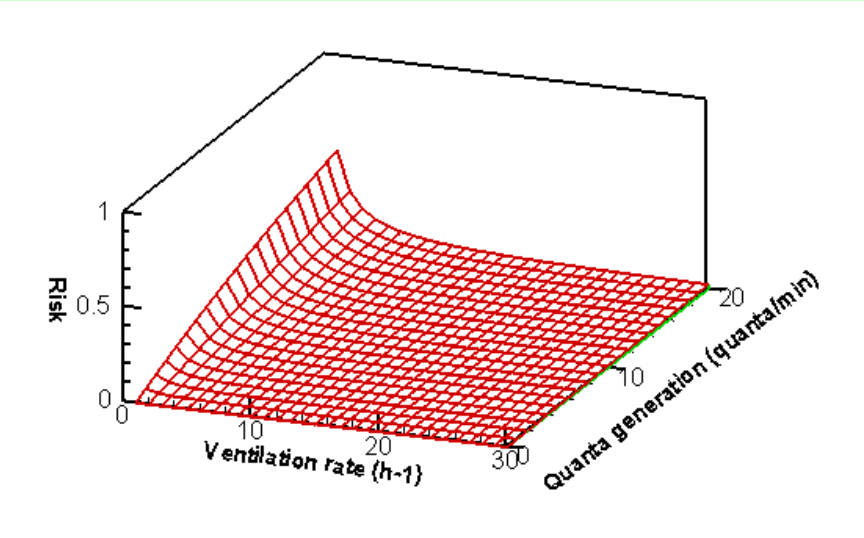
+ F

§ N

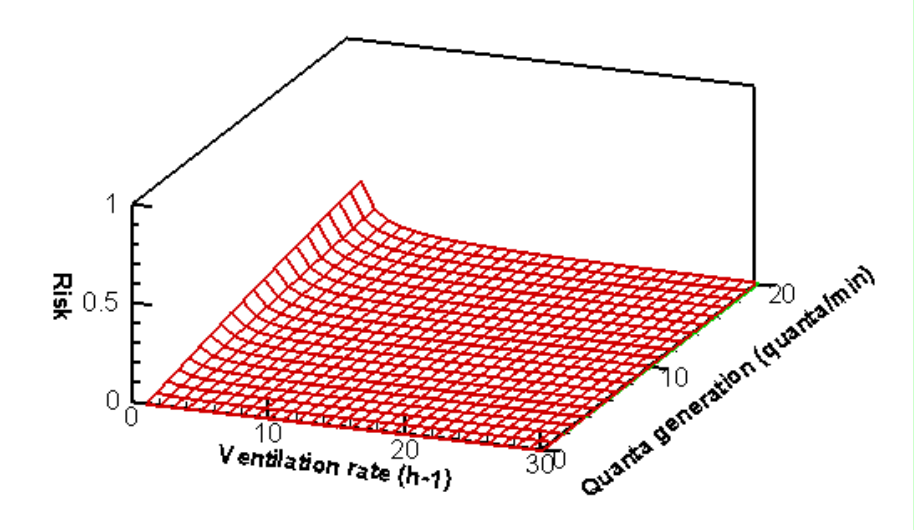
- sealed room, approximately 0.5-sq. ft. leakage;
- clean to dirty air flow;
- monitoring;
- ≥12 air changes per hour (ACH) new or renovation, 6 ACH existing; and
- exhaust to outside or HEPA-filtered if recirculated.



(a) 15 minutes exposure time



(b) 10 minutes exposure time



(c) 5 minutes exposure time

Graphs constructed by Wells-Riley equation to express the relationship between infection risk over ventilation rate, quanta generation rate and exposure time.

Measurements in Grantham Chest Hospital Hong Kong (tests in 4 rooms)

Windows open (100%), Doors open (100%)	= 45.4 ACH
Windows open (100%), doors close	= 20.2 ACH
Windows open (50%), doors close	= 15.5 ACH
Windows close , doors close	= 0.6 ACH
Windows close, doors open	= 3 .4 ACH

TB incidence in Grantham and HA hospitals 1996-2005

		Mean Incidence (per 100,000 pat year)
HA hospitals:	(257 cases)	60.4
GH:	(5 cases)	65.2

p = 0.9

Journal of TB and Lung Diseases; Oct 2005

AR Escombe et al:

65 rooms in 8 hospitals in Lima, Peru

Old Facilities: Median 37 ACH

Modern Facilities: Median 18 ACH

Natural Ventilation for the Prevention of Airborne Contagion

Escombe et al, PLOS Medicine 2007:4:Issue 2: e68

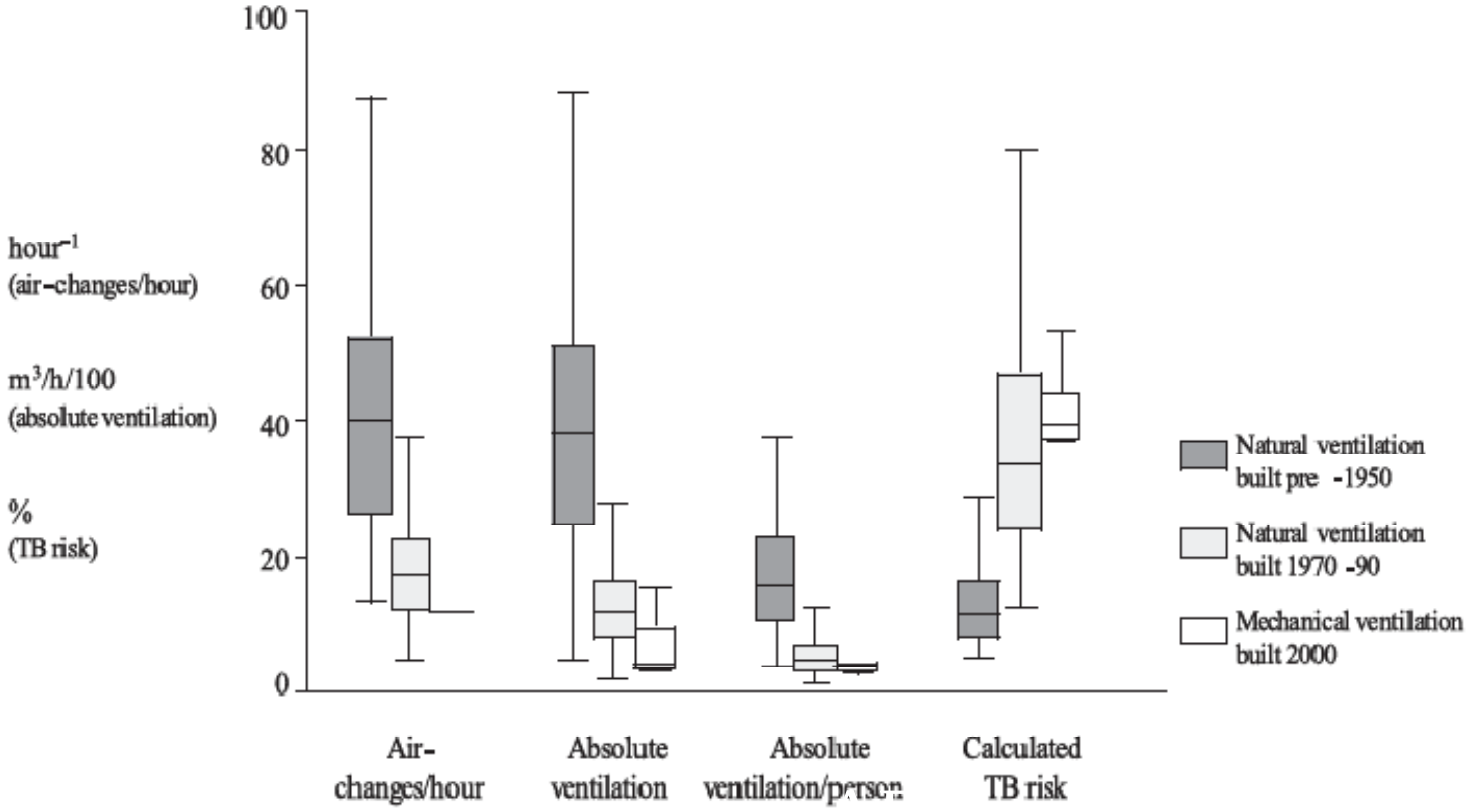
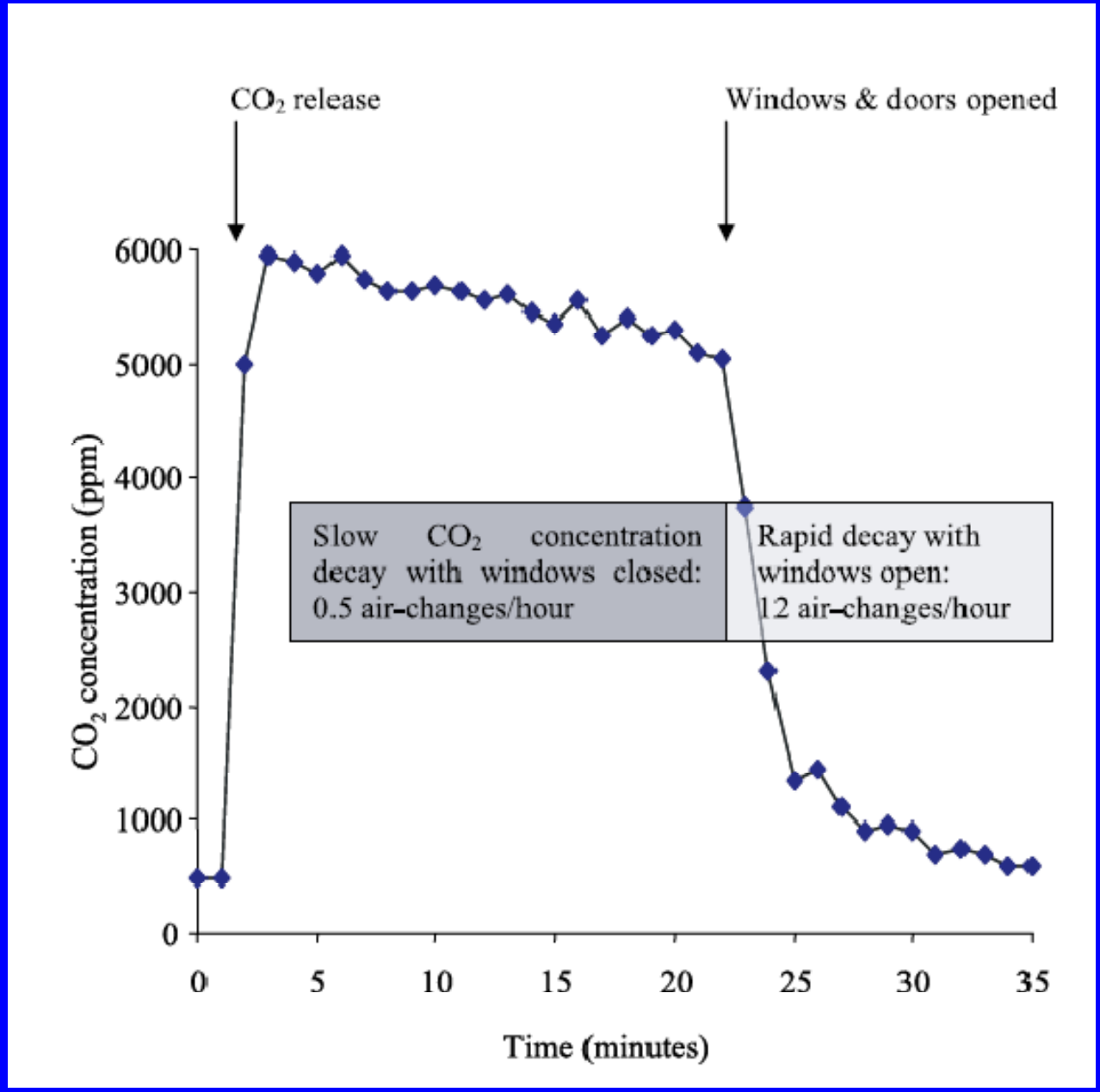


Figure 3. Ventilation and Protection against Airborne TB Transmission in Old-Fashioned Compared with Modern Rooms


CO_2 release
Windows & doors opened
6000
5000
4000
3000
2000
1000
0
CO_2 concentration (ppm)
Slow CO_2 concentration decay with windows closed: 0.5 air-changes/hour
Rapid decay with windows open: 12 air-changes/hour
0
5
10
15
20
25
30
35
Time (minutes)

WHO Publication/Guidelines

Natural Ventilation for Infection Control in Health-Care Settings

Edited by:
James Atkinson, Yves Chartier, Carmen Lúcia Pessoa-Silva, Paul Jensen, Yuguo Li and Wing-Hong Seto

http://www.who.int/water_sanitation_health/publications/natural_ventilation.pdf

Marion A. Kainer MD, MPH, FRACP
Medical Epidemiologist/ Infectious Diseases Physician
Director, Hospital Infections and Antimicrobial Resistance Program Tennessee Dept. of Health

Dr Seto,

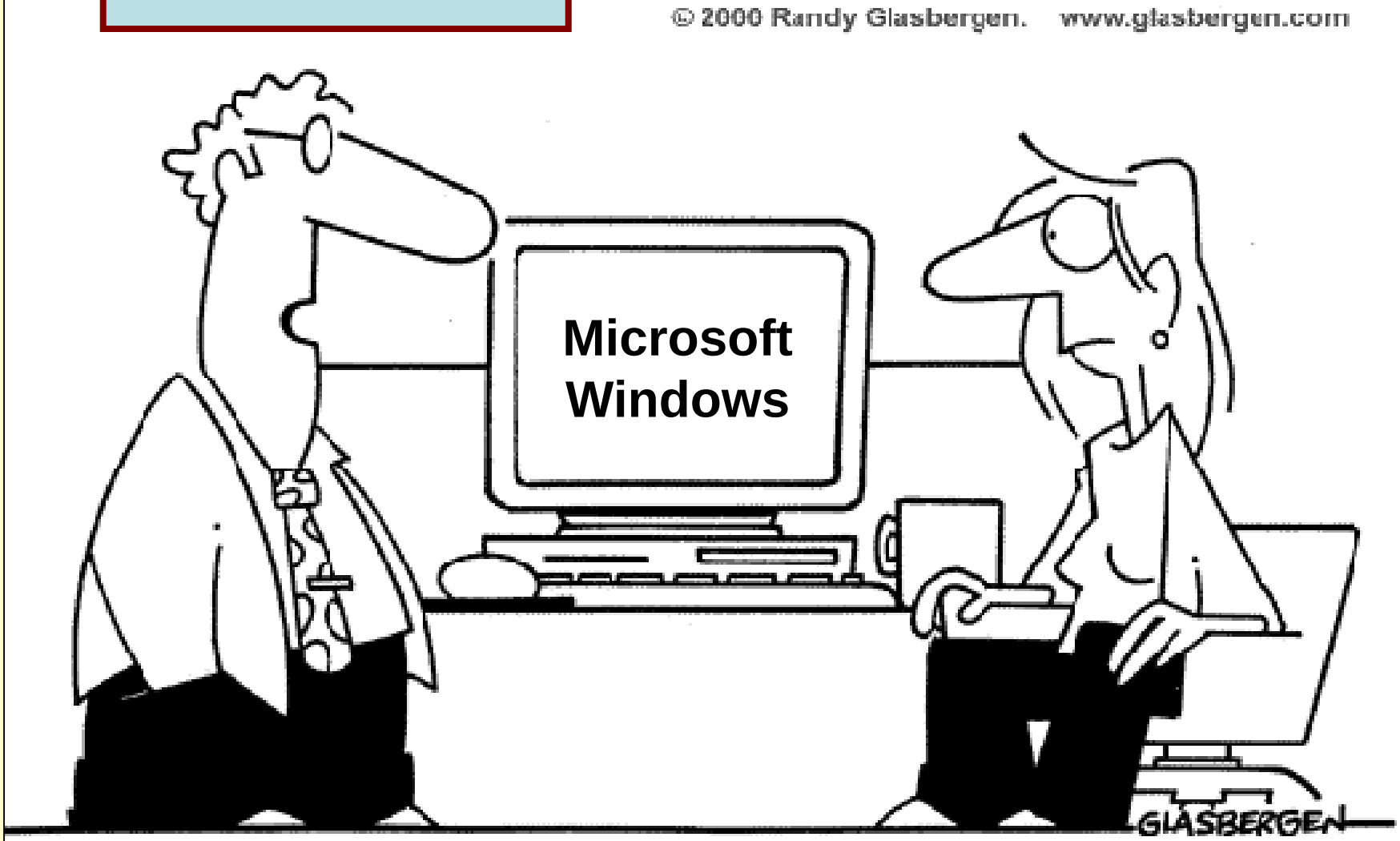
I really enjoyed your insightful presentation yesterday... I am sorry you had to skip through so many of the slides in the interests of time.

I did my infectious disease training in Australia at Fairfield hospital... a stand-alone infectious diseases hospital that saw/treated most of the TB patients in Victoria-- we had single rooms,]all of which opened up to a private balcony... we used lots of open air ventilation, high ACH and none of our staff converted their TSTs.

Opening your windows,

The key to natural ventilation..

Thank You



I mean...to open your room windows!


NEC
Thank you

Gram -ve may not need separate isolation

But only with good infection control practices

Thank you